

PTO 04-0670

Germany

Document No. DE 43 26 296 A 1

**Magnetic Disk Unit Facilitating Easy
Insertion of Head between Magnetic Disk**

[Magnetplatten-Einheit, welche ein leichtes Einsetzen eines
Magnetkopfes zwischen Magnetplatten bewirkt]

Akihiko Yamaguchi

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D.C.

November 2003

Translated by: Schreiber Translation, Inc.

Country : Germany

Document No. : DE 43 26 296 A 1

Document Type : Patent Application Laid Open
to Inspection

Language : German

Inventors : Akihiko Yamaguchi

Applicant : Fujitsu Ltd

IPC : G 11 B 5/60

Application Date : August 5, 1993

Publication Date : February 24, 1994

Foreign Language Title : Magnetplatten-Einheit, welche
ein leichtes Einsetzen eines
Magnetkopfes zwischen
Magnetplatten bewirkt

English Title : **Magnetic Disk Unit Facilitating
Easy Insertion of Head between
Magnetic Disk**

Specifications

Background of Invention

Field of Invention

This invention relates to a magnetic disk unit and a disk used in the magnetic disk unit.

Description of technique used

A reduction in the size and an increase in the capacity of a magnetic disk unit as a kind of an external computer memory [storage] have been desired for some time now. One of the methods for bringing about an increase in the capacity of the magnetic disk unit is to increase the number of magnetic disks mounted on a spindle. The assembly space between the magnetic disk in some of the newer magnetic disk units has been reduced in conjunction with an increase in the number of magnetic disk.

Generally, such a magnetic disk is constructed as a kind of recording medium for computers for example, from a substrate that is made up of a Al-Mg alloy, a current less coated foundation made up of Ni-P on the substrate, a magnetic film, that is made up of Co-Ni or Co-Ni-P by atomization on the current-less coated foundation, and a protective film that is made up of SiO₂ or the like on the magnetic field. Furthermore, the magnetic disk unit generally contains a spindle that is so

¹ Numbers in margin indicate pagination in foreign text.

setup as to be driven in a rotating manner, a plurality of magnetic disks that are mounted on the spindle and that are arranged at fixed intervals, a plurality of heads for the writing of data on the magnetic disk and reading of data recorded on the magnetic disks, a plurality of spring arms that are present at an interval from each other, for the purpose of carrying the heads, in each case on the former and a cart for the mobile carrying of the spring arms.

It is known that in a magnetic disk unit for computers, one uses a floating head to prevent damage on account of the contact with a magnetic disk. In such a magnetic disk unit, where one uses a floating head, the rotation of the magnetic disk at high speeds (3600 rpm) causes an air current so as to make the head float. A floating force is exerted upon the head, is balanced out by a spring force exerted on the head in order thus to maintain a precise spacing about $0.15\text{ }\mu\text{m}$ between the head and the magnetic disk as a result of data are recorded on the magnetic disk and data are read off the magnetic disk. In this type of magnetic disk unit, the distance between a head slide and the magnetic disk exerts great influence on the data reading and writing output. During the rotation of the magnetic disk as a result of the operation of the magnetic disk unit, a circumferential speed of the magnetic disk increases from the internal circumference to the outer circumference and therefore

the floating distance between the magnetic head slide and the surface of the magnetic disk from the inner circumferential segments to the outer circumferential segment of the magnetic disk is increased.

The protective film of the magnetic disk has essentially uniform thickness over the surface of the magnetic disk.

Accordingly, the distance between the head and the magnetic film along the outer circumferential segment of the magnetic disk is relatively great which causes a decline in the data reading and writing output. To solve this problem, the previously disclosed Japanese patent publication No. 1-263 930 proposed a magnetic disk where the thickness of the protective film along the inner circumferential segment of the magnetic disk is greater than the one along the outer circumferential segment. Such a change in the thickness of the protective film is intended to reduce the difference in the floating distance between the head and the magnetic film over the inner and outer circumferential segments of the magnetic disk as a result of which one can prevent a deterioration in the data reading and recording output.

It is well known that one can reduce the floating height of the head in order to improve the electromagnetic characteristics of the magnetic disk and various inventions were devised in order to make it possible to use the head at a low floating height. For example, the previously disclosed Japanese patent

publication No. 62-6438 proposed a magnetic disk where a substrate forming the magnetic disk, has a gently convex cross-section shape. Generally, a head in a magnetic disk unit for computers is constructed from a slide part that causes the head to float and a central rail part for reading and recording data from and upon the magnetic disk. Accordingly the design of the magnetic disk in such a convex shape contributes to a reduction of the floating height of the head on the central rail part as a result of which the electromagnetic characteristics of the magnetic disk are improved.

The trend in some of the newer magnetic head units is to increase the number of magnetic disk mounted on a spindle in order to increase the storage capacity. The increase and the number of magnetic disks mounted on the spindle demands a reduction of the assembly space of the magnetic disk on the spindle. The assembly space of the magnetic disk in the newer magnetic disk unit amounts to about 2.3 mm. Consequently, the space between neighboring spring arms that thereupon carry the heads is reduced and therefore it is very difficult to insert the heads that are carried on the neighboring spring arms between the neighboring magnetic disk.

The technique disclosed in the above mentioned previously disclosed Japanese patent publication No. 1-2 63 930 is used to prevent the decline in the data reading and recording output

along the outer circumferential segment of the magnetic disk in that the thickness of the protective film of the magnetic disk on the inner circumferential segment is made larger than on the outer circumferential segment. But this technique does not serve to solve the problem which is represented as a fact that the head are difficult to insert. This thickness of the protective film of the magnetic disk is very small, for instance, 60 nm on the inner circumferential segment and 50 nm on the outer circumferential segment, which thickness can be ignored in comparison to the thickness of the substrate. The substrate of the magnetic disk described in this patent publication, has a uniform thickness from the inner circumference to the outer circumference. Accordingly, one can determine that the thickness of the magnetic disk on the whole is essentially uniform.

On the other hand, in the magnetic disk that is disclosed in the above mentioned previously disclosed Japanese patent publication No. 62-6438 the substrate is made so as to display a gentle convex cross-section shape. The shaping of the substrate in such a convex shape is intended to reduce the distance between the magnetic film on the magnetic disk and the central rail part of the head and as a result, to improve the electromagnetic characteristics of the magnetic disk. /2

But this technique is not used to solve the above problem which occurs in the case where the assembly space of the magnetic disk on the spindle is narrowed.

SUMMARY OF INVENTION

The object of the invention therefore is to provide a magnetic disk with such a shape as to make it possible for a head to be easily inserted between such magnetic disk that are mounted in a spindle and that are arranged at fixed intervals.

It is also an object of the invention to provide a magnetic disk unit that will bring about the easy insertion of a head between a plurality of neighboring magnetic disk that are mounted on a spindle and that are arranged at fixed intervals.

It is another object of the invention to provide a magnetic disk unit that will make it possible to assemble many magnetic disks in a predetermined standard size.

According to an aspect of the invention at hand, a magnetic disk is provided with a plate shaped substrate that has a thickness for which decreases continuously from an intermediate position between a center of the mentioned substrate and an outer circumference of the mentioned substrate toward the mentioned outer circumference of the mentioned substrate; a magnetic film formed on the mentioned substrate and a protective film formed on the mentioned magnetic film.

Preferably, the substrate is tapered from the intermediate position to the outer circumference and the tapering angle of the substrate is set at less than 1° preferably 0.4° to 0.8° . Instead of the tapering shape, the substrate can have a flat surface on one side and an oblique surface on the other side. Furthermore, the substrate can have a curved shape that curves gently from the intermediate position toward the outer circumference on at least one side.

According to yet another aspect of the invention at hand, there is provided a magnetic disk unit with a base; a spindle that is supported rotatable on the mentioned base; a drive device for rotating the mentioned spindle; a magnetic disk that is mounted on the mentioned spindle or by the mentioned magnetic disk has a thickness that decreases continually from an intermediate position between a center of the mentioned disk and an outer circumference of the mentioned toward the mentioned outer circumference of the mentioned disk; a head for recording data upon the magnetic disk and for reading data off the mentioned magnetic disk; a spring arm for carrying the mentioned head in order to keep the mentioned head in contact with the mentioned magnetic disk while the mentioned magnetic disk is at rest, and to make it possible for the mentioned head to float off the mentioned magnetic disk when the mentioned magnetic disk is rotated in order to generate a dynamic pressure of the air

flow on account of the rotation of the mentioned magnetic disk; a device for carrying the mentioned spring arm in order to facilitate a movement of the mentioned head, that is carried on the mentioned spring arm in a radial direction of the mentioned magnetic disk; and activator for moving the mentioned head into the mentioned radial direction of the mentioned magnetic disk.

According to another aspect of the invention at hand, in a magnetic disk unit with a spindle that is so set up as to be driven in a rotating manner, a plurality of magnetic disk that are mounted on mentioned spindle and are arranged at fixed intervals, a plurality of heads for recording data upon the heads of mentioned magnetic disks and reading of data from the mentioned magnetic disks, a plurality of spring arms that are placed at an interval from each other for carrying the mentioned heads in each case on them [spring arms] and a device for the moveable carrying of the mentioned spring arms; a method for inserting neighboring ones of the mentioned heads between neighboring magnetic disks of the magnetic disks mentioned and the establishment of contact between the mentioned neighboring heads with the opposite surfaces of the mentioned neighboring magnetic disks, thus constituting a procedure which procedure comprises the following steps: formation of each of the mentioned magnetic disk in such a form that a thickness of each magnetic disk will continually decrease from an intermediate

position between a center of the mentioned magnetic disk and an outer circumference of the mentioned magnetic disk to the mentioned outer circumference of the mentioned magnetic disk; providing an insertion device with a plurality of insertion arms that are present at an interval from each other; moving the mentioned insertion arms of the mentioned insertion device in order to insert neighboring ones of the mentioned spring arms between the neighboring ones of the mentioned insertion arms and to press the mentioned neighboring spring arms against the pre-stress forces of the mentioned neighboring spring arms upon each other so that the mentioned neighboring heads that are supported on the mentioned neighboring insertion arms, can be inserted between opposite surfaces of the mentioned neighboring magnetic disk; insertion of the mentioned neighboring heads between the mentioned opposite surfaces of the mentioned neighboring magnetic disk; and removal of the mentioned neighboring insertion arms from the mentioned neighboring spring arms in order to establish contact between the mentioned neighboring magnetic disk with the mentioned opposite surface of the mentioned neighboring magnetic disk by virtue of the mentioned pre-stress forces of the mentioned neighboring spring arms.

According to the invention, the thickness of the substrate of the magnetic disk decreases continually from the intermediate position between the center and the outer circumference of the

substrate toward the outer circumference of the substrate. Accordingly, in the magnetic disk unit that contains a plurality of magnetic disks with such a shape in each case, the head can easily be inserted between the neighboring magnetic disk even though the space between the neighboring magnetic disk on their central parts is narrow. Furthermore, because the thickness of each magnetic disk reduced along its outer circumference segment, the magnetic disk can be made light in terms of weight in order to be suitable for high speed rotation. /3

By studying the following description and the enclosed claims with reference to the enclosed drawings which shows some preferred embodiments of the invention, the above and other objects, characteristics, and advantages at hand as well as the manner of their practical implementation will become more clearly visible and the invention itself will be understood in the best possible manner.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a diagram illustrating a top view on a magnetic plate unit according to a first preferred embodiment of the invention at hand.

Figure 2 is a diagram illustrating a side view of the magnetic disk unit shown in figure 1.

Figure 3 is a diagram illustrating a profile view of a magnetic disk used in the first preferred embodiment.

Figure 4 is a diagram illustrating a side view of a magnetic plate unit according to a second preferred embodiment of the invention at hand.

Figure 5 is a diagram illustrating a side view of a magnetic disk used in the second preferred embodiment.

Figure 6 is a diagram illustrating a side view of a magnetic plate unit according to a third preferred embodiment of the invention at hand.

Figure 7 is a diagram illustrating a side view of a magnetic disk used in the third preferred embodiment.

Figure 8 is a diagram illustrating a side view of a magnetic disk unit according to a forth preferred embodiment of the invention at hand.

Figure 9 is a diagram illustrating a side view of a magnetic disk used in the forth preferred embodiment.

Figure 10 is a diagram illustrating a side view of a magnetic plate unit according to a fifth preferred embodiment of the invention at hand.

Figure 11 is a diagram illustrating a side view of a magnetic disk used in the fifth preferred embodiment.

Figures 12A, 12B and 12C are diagrams showing side views that illustrate the procedure for the insertion of heads of the invention at hand.

Figures 13A, 13B and 13C are diagrams showing top views that illustrate a procedure for the insertion of the heads according to the invention at hand.

Figures 14A and 14B are diagrams showing side views illustrating the operation of an insertion device that is used for the insertion of the heads according to the invention at hand.

Figures 15A and 15B are diagrams showing side views that illustrate the effect of the invention at hand.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

We will now describe some preferred embodiments of the invention at hand with reference to the drawings. Refer now to Figures 1 and 2 we are looking at a magnetic disk unit according to a first preferred embodiment of the invention. A spindle 2 is mounted rotatable by a bearing (not shown) on a base 4. Spindle 2 is driven in a rotating manner by a spindle motor (not shown). A plurality of magnetic disk 6 and a plurality of ring-shaped spaces 8 are stacked alternately and are arranged around spindle 2. Thus, magnetic disks 6 are mounted on spindle 2 and are arranged at fixed intervals. A disk clamp 10 is attached to spindle 2 by screws as a result of which each magnetic disk 6 is firmly clamped between the neighboring ring shaped spaces 8 and each magnetic disk 6 is fixed upon spindle 2.

The reference number 14 refers to an actuator shaft that runs upright from base 4. A plurality of arms 16 are mounted rotatably on actuator shaft 14. A pair of spring arms 18 is mounted on both sides of each arm 16 to exert pre-stressing forces which are directed away from each other. A head 20 is mounted on each spring arm 18 upon a free terminal part thereof in order to record digital data from the corresponding magnetic disk 6 and in order to read digital data recorded on the corresponding magnetic disk 6.

Arms 16 are rotated around activator shaft 14 in that an oscillation coil motor 22 is driven and accordingly the heads 20 that are mounted on the spring arms 18 upon their free terminal parts, are moved in the radial direction of the magnetic disk 6 as a result of which digital data are recorded on the entire data surfaces of magnetic disk 6 and digital data recorded on all of the data surfaces of the magnetic disk 6 are read. The reference number 24 refers to a cover that surrounds the magnetic disk unit.

The structure of each magnetic disk 6 according to the first preferred embodiment is described with reference to figure 3. Magnetic disk 6 is made up of a substrate 7 that consist of an Al-Mg alloy, a magnetic film 9 that consists of Cu-Ni-P or Co-Ni by coating or atomization by virtue of a current-less coated foundation (not shown) made of Ni-P on the substrate and

a protective film 11 that is made of SiO_2 and is formed on magnetic film 9. Substrate 7 has opposite flat surfaces that extend parallel to each other on a central firmly clamped part 6a and has opposite oblique surfaces that extend radially outward from a given position 6b which rest against the firmly clamped part 6a toward the outer circumference of magnetic disk 6. The current-less coated foundation, the magnetic field 9 and the protective film 11 in each case are made so as to have a uniform thickness over the opposite surfaces of the substrate 7. The thickness of each film is very small compared to the thickness of substrate 7 so that the total thickness of these films can be ignored with relation to the thickness of the magnetic disk 6.

The magnetic disk 6 according to the first preferred embodiment is a 3.5 - inch magnetic disk with a thickness of 0.8 mm on the central firmly clamped part 6a and a thickness of 0.3 mm on the outer circumference and with an angle that is defined by both surfaces of the magnetic disk 6, that is to say a taper angle of about 0.5° . Furthermore, the diameter of a central hole of the magnetic plate 6 amounts to 25 mm and the diameter of the firmly clamped part 6a amounts to 32.6 mm. To accomplish the purpose of the invention at hand, the taper angle is preferably set at no more than 1° and in a preferred manner. It is set within a range of 0.3° to 0.8° . When the taper angle

amounts to less than $0.3 [^\circ]$ the effectiveness of the invention at hand would not become noticeable with respect to the conventional magnetic disk, where both surfaces extends parallel to each other. When the taper angle amounts to more than 0.8° , the electromagnetic characteristics of the magnetic disk would be influenced in a more or less disadvantageous manner. /4

Referring now again to Figure 2, the space between the firmly clamped part 6a of the neighboring magnetic disk 6 is set at about 2.3 mm and the pair of heads 20, between the neighboring magnetic disk 6 is pressed against the data surfaces of the neighboring magnetic disk 6 by the pre-stressing forces of the corresponding spring arms 18. Furthermore, the space between the outer circumferences of the neighboring magnetic disk 6 is set at about 2.8 mm so that a pair of heads 20 can be inserted relatively easily between the neighboring magnetic disk 6.

If each magnetic disk 6 is rotated at high speeds by the spindle motor, then a dynamic pressure is generated on account of the airflow. Consequently, the pre-stressing force of each spring arm 18 - that presses head 20 against magnetic disk 6 - is equalized with a floating force of the head 20 from magnetic disk 6. Accordingly, each head 20 floats about $0.15 \mu\text{m}$ off the data surface of the corresponding magnetic disk 6 in order thus to bring about a recording of digital data upon the data surface

of magnetic disk 6 and a read-out of digital data recorded on the data surface of magnetic disk 6.

As described in detail with reference to figure 3, each magnetic disk 6 according to the first preferred embodiment with the exception of the central firmly clamped part 6a is so tapered that the thickness decreases continually from position 6b to the outer circumference. Accordingly - even if the space between the neighboring magnetic disk 6 on the firmly clamped part 6a is narrow - the space on the outer circumferences of the magnetic disk 6 can be made wide to a certain extent so that heads 20 can be easily inserted between magnetic disk 6 by means of a method to be described below.

Referring now to figure 4, see a magnetic disk unit according to a second preferred embodiment of the invention at hand. In the magnetic plate unit according to the second preferred embodiment, one uses a plurality of magnetic disk 6A that in each case display opposite oblique surfaces only along the outer circumferential segment of the data surfaces instead of along all of the data surfaces. The taper angle of each magnetic disk 6A along the outer circumference segment here from is set from about 0.6° to 0.2° . As one can see in figure 5, magnetic disk 6A has opposite flat surfaces that extend parallel to each other on the central firmly clamped part 6a toward an essentially radial position and displays oblique surfaces that

extend radially outward from position 6c to the outer circumference. The other design of the second preferred embodiment essentially is the same as the one for the first preferred embodiment.

Referring now to figure 6, we see a magnetic disk unit according to a third preferred embodiment of the invention at hand. In the magnetic disk unit according to the third embodiment, one uses a plurality of magnetic disk 6B which in each case display an oblique surface only on the underside [lower side]. As one can see in figure 7, magnetic disk 6B has opposite flat surfaces that run parallel toward each other along the central firmly clamped part 6a, an upper flat or horizontal surface that runs radially outward from the firmly clamped part 6a to the outer circumference and a lower oblique surface that extends radially outward and that rises from position 6b toward the outer circumference. The other design of the third preferred embodiment essentially is the same as the one for the first preferred embodiment. As an alternative, the upper flat surface and the lower oblique surface can be replaced by an upper oblique surface or a lower flat surface.

Referring now to figure 8, we see a magnetic disk unit according to a fourth preferred embodiment of the invention at hand. In the magnetic disk unit according to the fourth preferred embodiment, one uses a plurality of magnetic disk 6C

that in each case display opposite curved surfaces. As one can see in figure 9, magnetic disk 6C has opposite flat surfaces that extend parallel toward each other on the central firmly clamped part 6a and displays opposite curved shapes that extend radially outward from position 6b toward the outer circumference. Each curved surface has a curvature radius in the range of 1400 to 1800 mm. The other design of the fourth preferred embodiment is essentially the same as the one for the first preferred embodiment.

Referring now to figure 10, we see a magnetic disk unit according to a fifth preferred embodiment of the invention at hand. In the magnetic disk unit according to the fifth preferred embodiment, one uses a plurality of magnetic disk 6D that in each case display a curvature only at the lower side [underside]. As one can see in figure 11, magnetic disk 6D has opposite flat surfaces that extend parallel toward each other on the central firmly clamped part 6a, an upper or horizontal surface that extends radially outward from the firmly clamped part 6a to the outer circumference and a lower curved surface that extends radially outward and that curves upward in an arched form from position 6b to the outer circumference. The other design of the fifth preferred embodiment is essentially the same as the one for the first preferred embodiment. As an alternative, the upper flat surface and the lower curved surface

can be replaced by an upper curve surface or a lower flat surface.

Now we will describe a process for inserting heads 20 between magnetic disk 6 with reference to figure 12A to 14B. First of all, referring now to figure 13A, the reference number 30 designates an insertion device with a body 32. Body 32 of the insertion device 30 is made with a curved groove 33 into which is inserted a lever 34. As shown in figures 14A and 14B, lever 34 is connected with a plurality of pairs of insertion arms 36. The insertion arms 36 are moved with relation to body 32 in that lever 34 is moved in groove 33.

As shown in figure 14, which corresponds to figures 12A and 13A, in each pair of spring arms 18 is grasped by the corresponding pair of insertion arms 36 against the pre-stressing forces hereof. When lever 34 in groove 33 in this condition is moved to a position shown in figure 13B, then each pair of insertion arms 36 is extended from body 32 of insertion device 30 in order to move each pair of spring arms 18 toward each other and accordingly to insert each pair of magnetic heads 20 between the neighboring magnetic disk 6, as shown in figure 12B. /5

Then when lever 34 has been returned to its original position in groove 33, as shown in figure 13c [sic] each pair of insertion arms 36 is retracted into body 32 of insertion device 30, and

each pair of head 20 remains behind between the neighboring magnetic disk 6 accordingly, a clamping force of the insertion arms 36, that was exerted upon spring arms 18 is removed and the magnetic heads 20 are placed in contact with the surfaces of magnetic disk 6 along their circumferential segments as shown in figure 12C.

As shown in figure 14A, each pair of insertion arms 36 is made on their free terminal parts with opposite inclined surfaces 36a that diverge to their free ends. Accordingly, when lever 34 is moved in groove 33 of body 32 of insertion device 30, from the state shown in figure 14A into the state shown in figure 14B, then each pair of spring arms 18, that are grasped by the diverging ends of the inclined surfaces 36a of the insertion arms 36 are forced to move toward each other in contact with the inclined surfaces 36a, while insertion arms 36 are extended from body 32. Accordingly, it now becomes possible for each pair of heads 20 - that are mounted on the spring arms 18 upon their free terminal parts - to be inserted between the neighboring magnetic disk 6.

The advantageous effect of the invention at hand will be described with reference to figures 15A and 15B when compared to the state of art.

Figure 15A shows one way of inserting a pair of heads 20 between conventional magnetic disk 6' which in each case display

opposite flat surfaces that extend parallel to each other from the center toward the outer circumference. Looking at the state of the art shown in figure 15A, spring arms 18 must, prior to the insertion of the heads 20 between magnetic disk 6' be completely compressed by insertion arms 36 because the space between magnetic disk 6' along their outer circumferences is narrow.

On the other hand, figure 15B shows a way of inserting heads 20 between magnetic disk 6 according to the invention at hand. As shown in figure 15B, it is not required that the degree of pressure of the spring arms 18 by the insertion arms 36, prior to the insertion of the heads 20 between the magnetic disk 6 is made so great because the space between magnetic disk 6 along their outer circumferences is great to a certain extent. Accordingly, heads 20 that are mounted on spring arms 18 on their free terminal parts can be easily inserted between neighboring magnetic disk 6. In the magnetic disk unit according to the first preferred embodiment of the invention at hand as mentioned earlier the space between the neighboring disk 6 on the firmly clamped part 6a is set at about 2.3 mm and the space along the outer circumferences is set at about 2.8 mm so that heads 20, are mounted on spring arms 18 on their free terminal parts can be easily inserted between neighboring magnetic disk 6.

While the invention was referenced to specific embodiments, the description serves for explanation that is not to be considered as a restriction of the framework of the invention. Various modifications and exchanges can be readily obvious to the expert without going beyond the basic idea and the context of the invention as defined by the enclosed claims.

CLAIMS

1. Magnetic disk with a disk-shaped substrate that has a thickness which decreases continually from an intermediate position between a center of the mentioned substrate and an outer circumference of the mentioned substrate toward the mentioned outer circumference of the entire substrate; a magnetic film formed on the mentioned substrate; and a protective film formed on the mentioned magnetic film.
2. Magnetic disk according to claim 1 where the mentioned substrate is tapered from the mentioned intermediate position to the mentioned outer circumference.
3. Magnetic disk according to claim 1 where the mentioned substrate displays a flat surface on one side of the mentioned substrate and an oblique surface on the other side of the mentioned substrate where the mentioned oblique surface is inclined with reference to the mentioned flat surface and extends from the mentioned intermediate positioned to the mentioned outer circumference.

4. Magnetic disk according to claim 1 where the mentioned substrate displays curved surfaces on both sides of the mentioned substrate, where the mentioned curved surfaces extend from the mentioned intermediate position to the mentioned outer circumference.

5. Magnetic disk according to claim 1 where the mentioned substrate displays a flat surface on one side of the mentioned substrate and a curved surface on another side of the mentioned substrate, where the mentioned curved surface extends from the mentioned intermediate position to the mentioned outer circumference.

6. Magnetic disk unit with a base; a disk carrier device that is mounted rotatable on the mentioned base. A magnetic disk that is mounted on the mentioned plate carrier device where the magnetic disk has a thickness that decreases continually from an intermediate position between a center of the mentioned disk and an outer circumference of the mentioned disk to the mentioned outer circumference of the mentioned disk; a magnetic head for recording data on the mentioned magnetic disk and reading data off the mentioned magnetic disk; a spring arm for carrying the mentioned head, in order to keep the mentioned head in contact with the mentioned magnetic disk while the mentioned magnetic disk is at rest in order to make it possible that the mentioned head will float from the mentioned magnetic disk, when the

mentioned magnetic disk is rotated in order to generate a dynamic pressure of the airflow on account of the rotation of the mentioned magnetic disk. /6

A device for carrying the mentioned spring arm to facilitate a movement of the mentioned head that is carried on the mentioned spring arm, in a radial direction of the mentioned magnetic disk; an activator device moving the mentioned head in the mentioned radial direction of the mentioned magnetic disk.

7. Magnetic disk unit according to claim 6, where the mentioned magnetic disk comprises a plurality of magnetic disk that are mounted on the mentioned spindle and are arranged in fixed intervals and which magnetic disk unit furthermore comprises the following: a plurality of spacers that are mounted on the mentioned spindle, where each of the mentioned spacers is arranged between neighboring magnetic disk; a device for firmly clamping the mentioned magnetic disk with the mentioned spacers.

8. Magnetic disk unit according to claim 7 where each of the mentioned magnetic disk tapers from the mentioned intermediate positions to the mentioned outer circumference.

9. Magnetic disk unit according to claim 7 where each of the mentioned magnetic disk display curved surfaces on both sides thereof, where by the mentioned curved surfaced extend from the

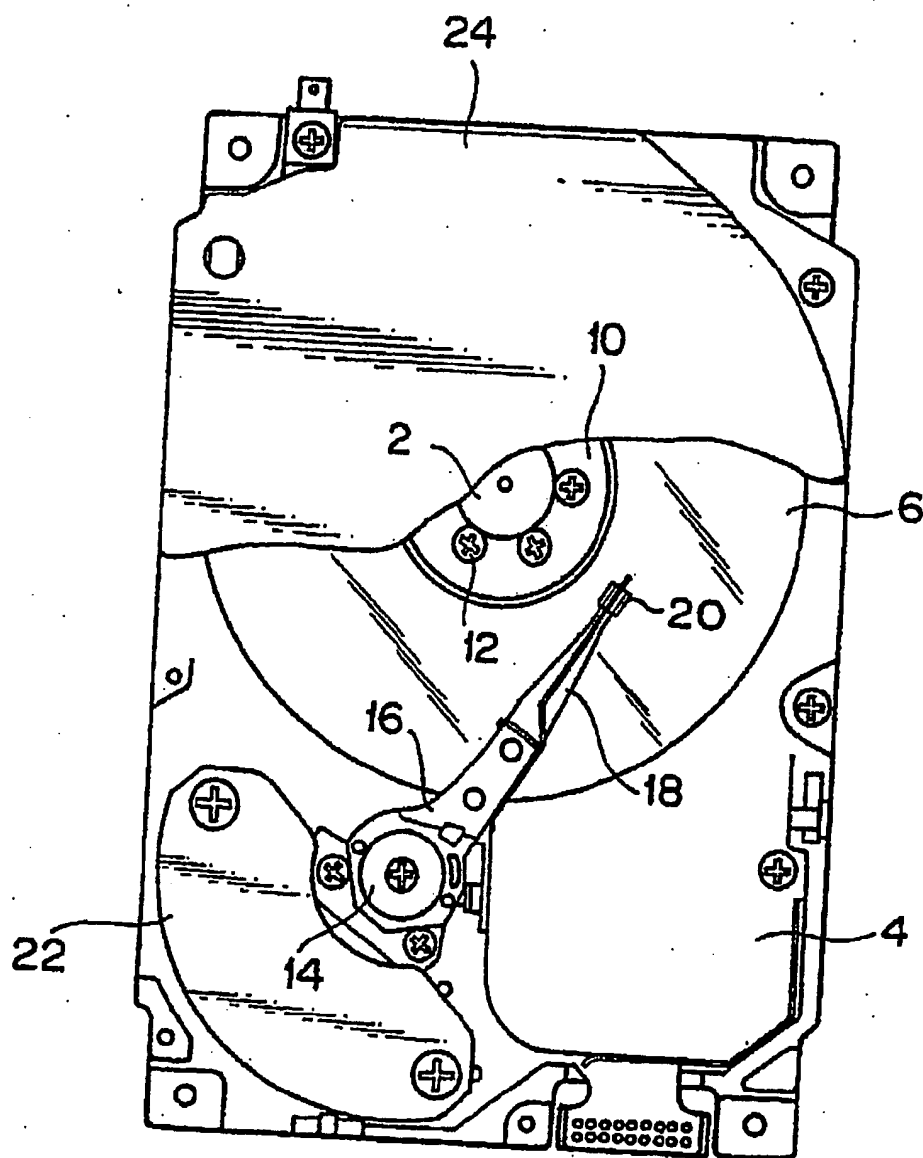
mentioned intermediate position to the mentioned outer circumference.

10. In a magnetic disk unit with a disk carrier device, that is set up in order to be driven in a rotating manner, a plurality of magnetic disk that are mounted on the mentioned disk carrier device and that are arranged at fixed intervals, a plurality of heads for recording data on the mentioned magnetic disk and reading data off the mentioned magnetic disk, a plurality of spring arms that are present at an interval from each other for the purpose of carrying the mentioned heads on each of them and a device for the mobile carrying of the mentioned spring arms; process for the insertion of neighboring heads of the mentioned heads between neighboring disks of the mentioned magnetic disk and establishing contact between the mentioned neighboring heads and opposite surfaces of the mentioned neighboring magnetic disk; which process comprises the following steps: shaping each of the mentioned magnetic disk in such a form that a thickness of each mentioned magnetic disk will continually decrease from an intermediate position between a center of each mentioned magnetic disk and an outer circumference of the mentioned magnetic disk to the mentioned outer circumference of the mentioned magnetic disk; providing an insertion device with a plurality of insertion arms that are present at an interval from each other; moving the mentioned insertion arms of the mentioned

insertion device in order to grasp neighboring arms of the mentioned spring arms between neighboring arms of the mentioned insertion arms and pressing the mentioned neighboring spring arms against the pre-stressing forces of the mentioned neighboring spring arms upon each other so that the neighboring magnetic heads that are carried on the mentioned neighboring insertion arms can be inserted in opposite surfaces of the mentioned neighboring magnetic disk; insertion of the mentioned magnetic heads between the mentioned opposite surfaces of the mentioned neighboring magnetic disk; and removal of the mentioned neighboring insertion arms from the mentioned neighboring spring arms in order to establish contact between the mentioned neighboring heads with the mentioned opposite surfaces of the mentioned neighboring magnetic disks by virtue of the mentioned pre-stressing forces of the mentioned neighboring spring arms.

11 sheets of drawings.

FIG. 1



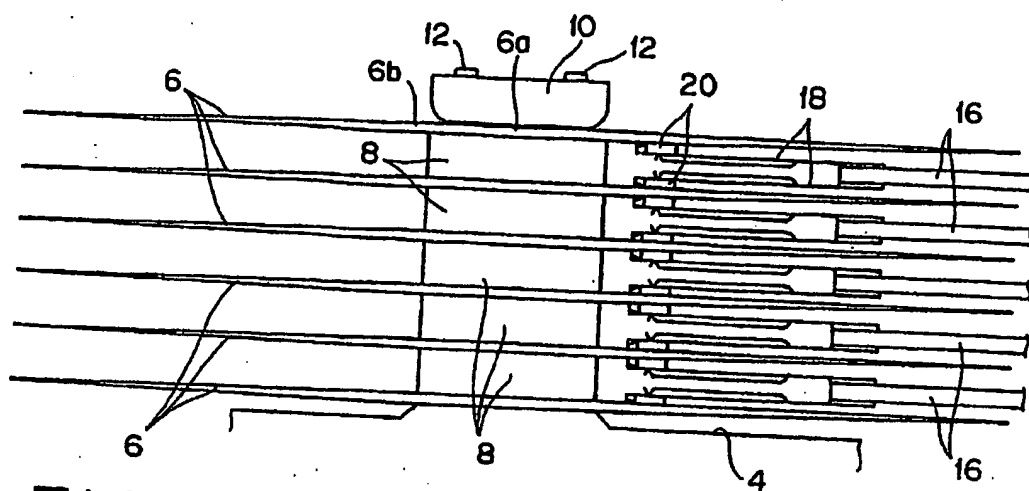


FIG. 2.

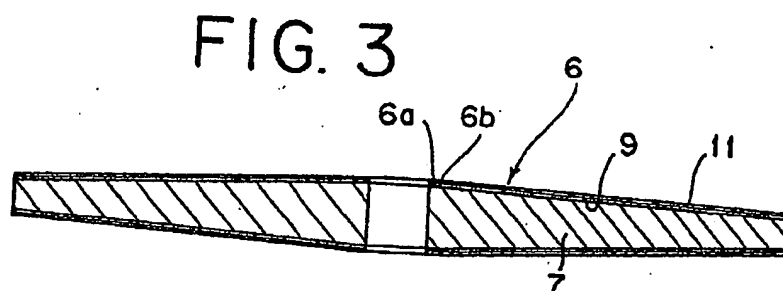


FIG. 3

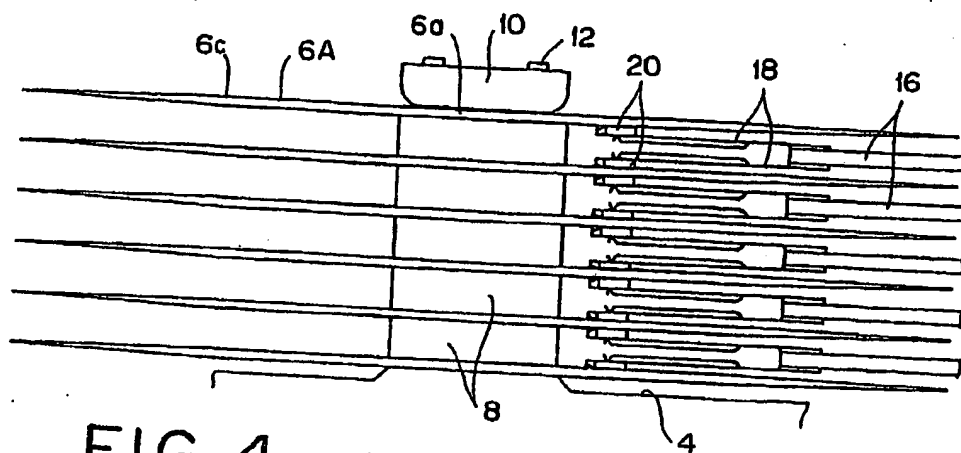


FIG. 4

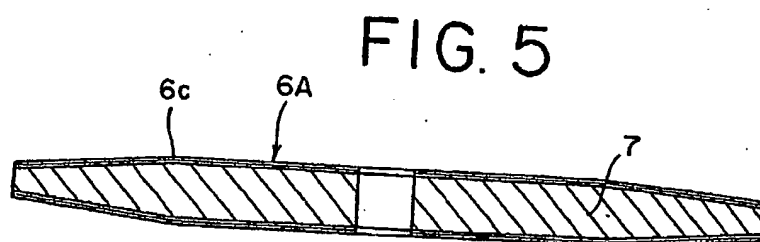


FIG. 5

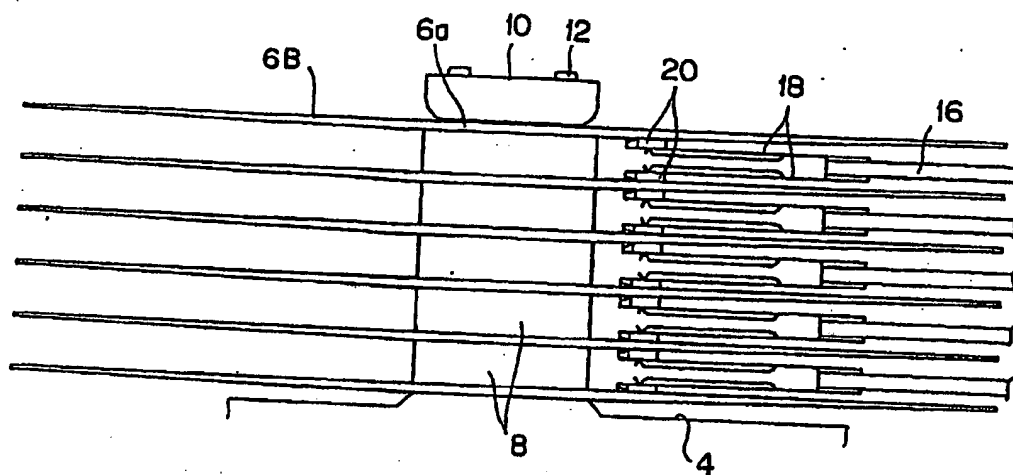


FIG. 6

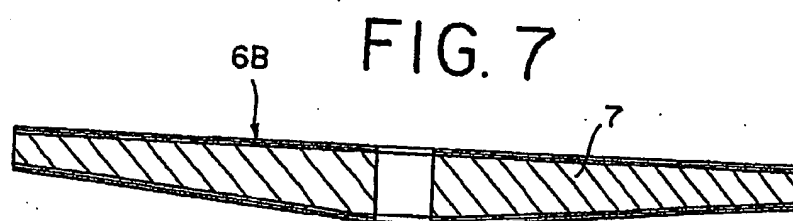


FIG. 7

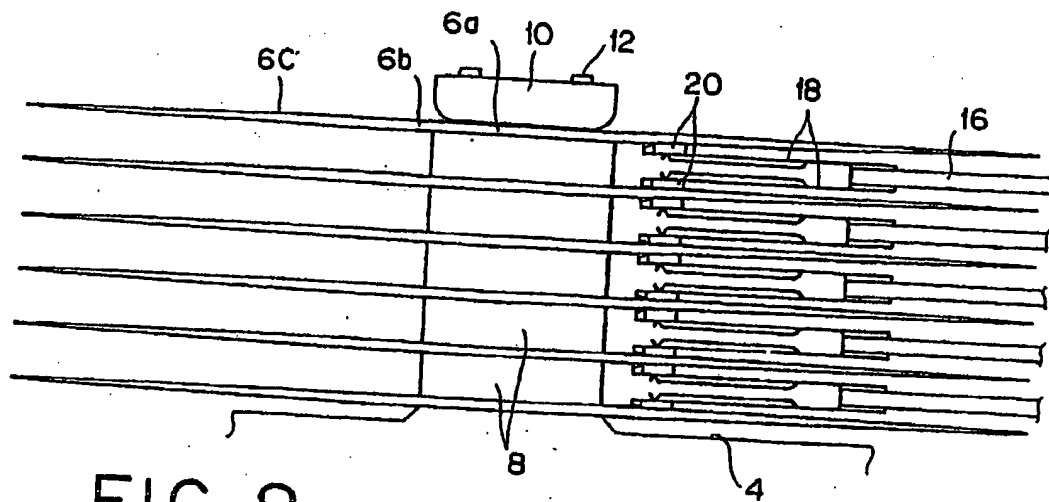


FIG. 8

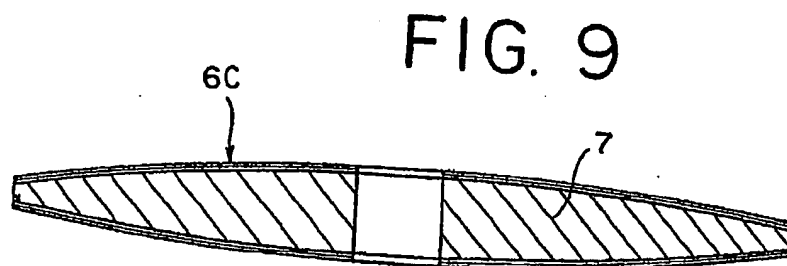


FIG. 9

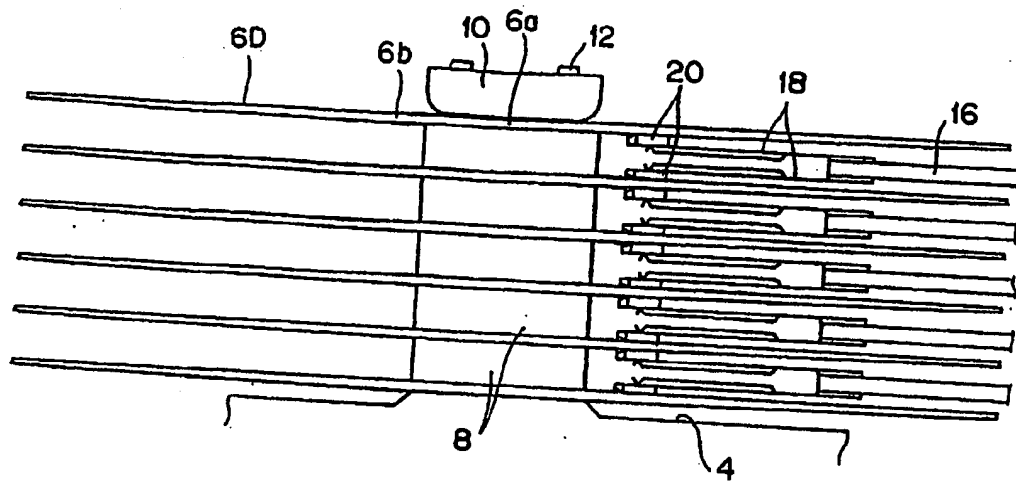


FIG. 10

FIG. 11

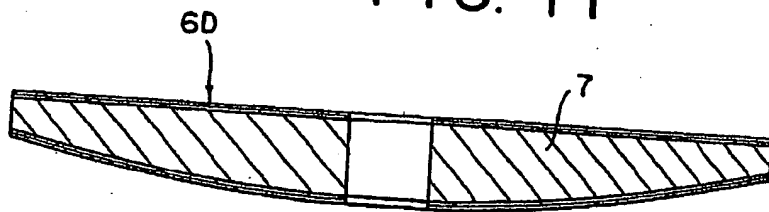


FIG. 12A

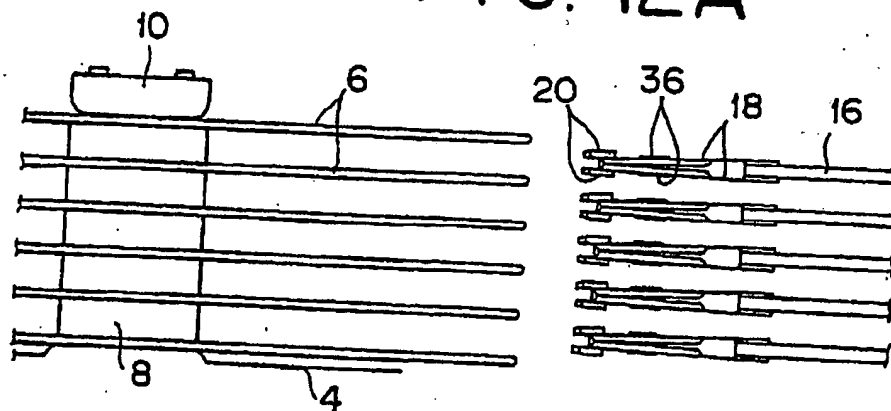


FIG. 12B

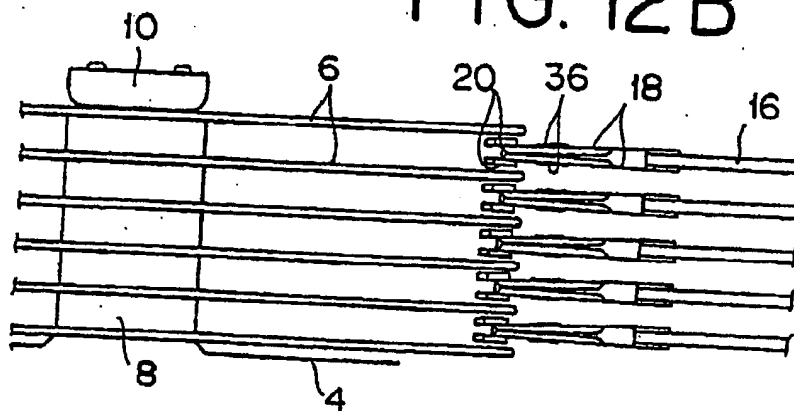


FIG. 12C

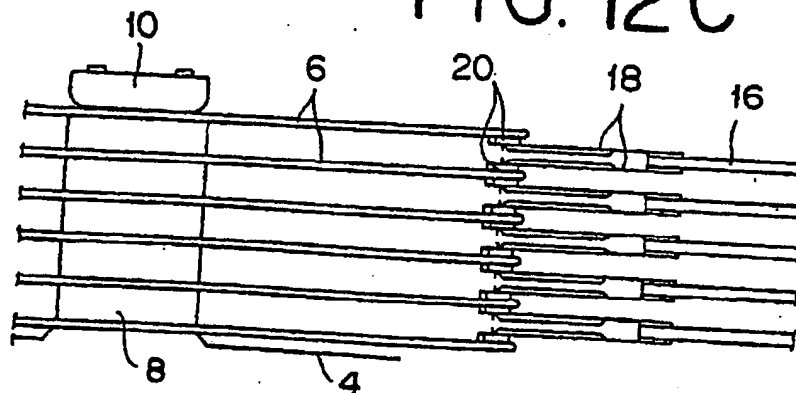


FIG. 13A

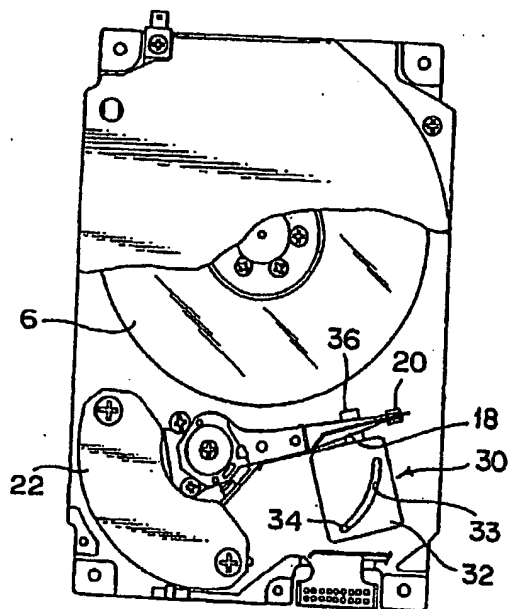


FIG. 13B

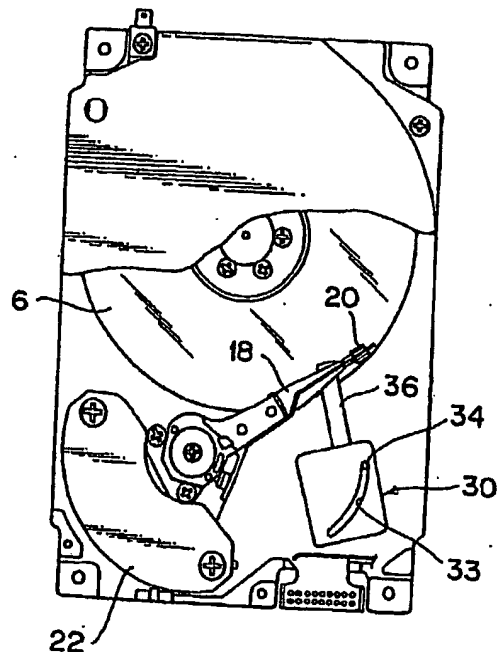


FIG. 13C

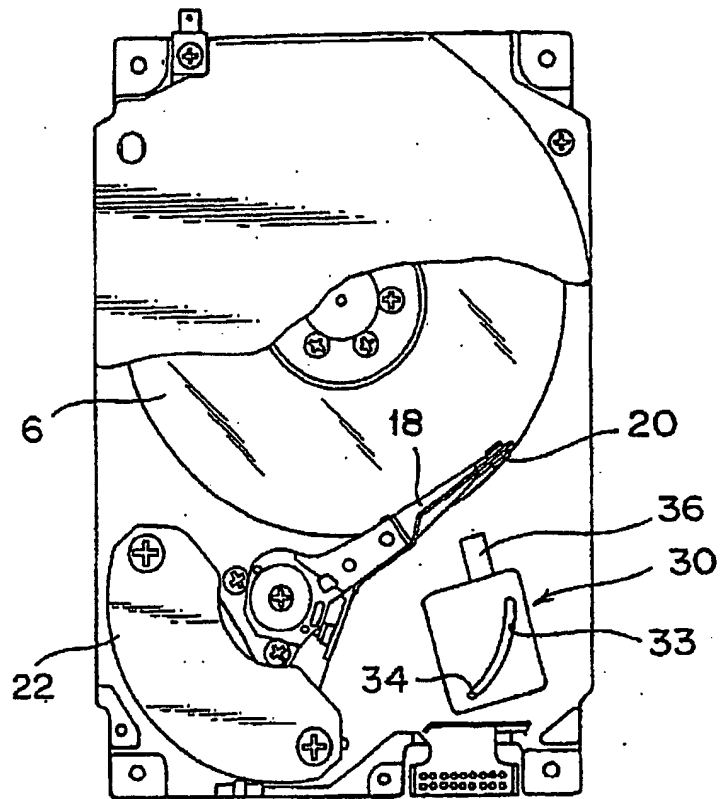


FIG. 14A

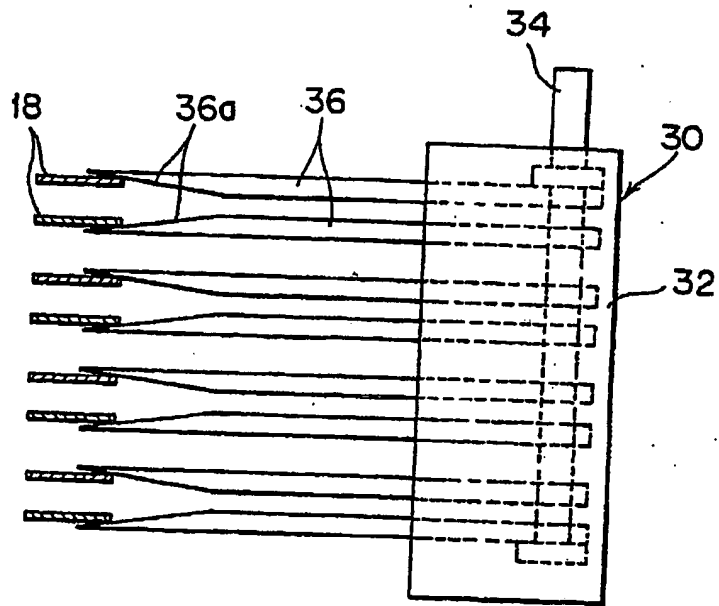


FIG. 14B

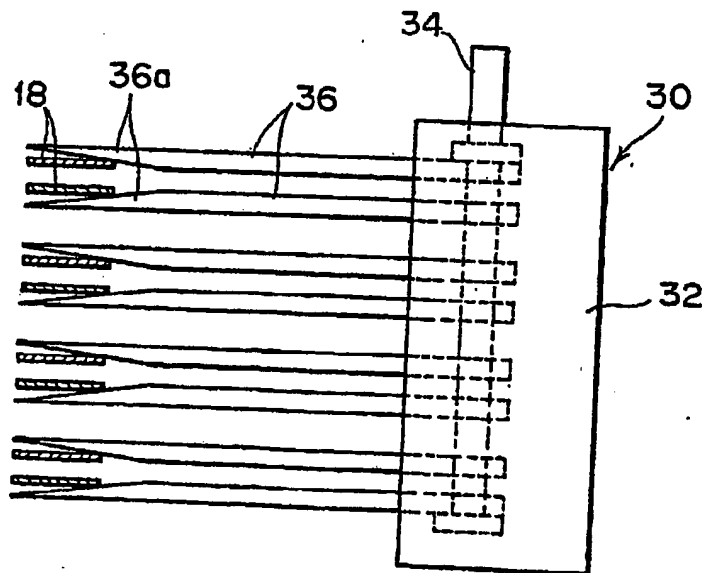


FIG. 15A

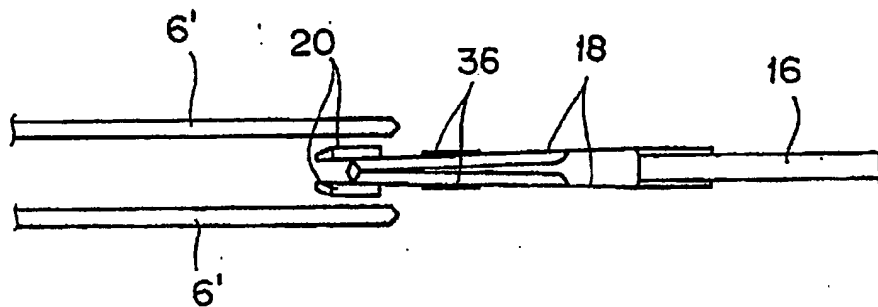


FIG. 15B

